FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 785. (No. 2, Vol. XVI.) JANUARY 10, 1924 [Weekly, Price 6d. Post free, 7d.

Flight

The Aircraft Engineer and Airships

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C. 2
Telegrams: Truditur, Westcent, London. Telephone: Gerrard 1828

Annual Subscription Rates, Post Free:
United Kingdom .. 30s. 4d. Abroad 33s. 0d.*
These rates are subject to any alteration found necessary under abnormal conditions and to increases in postage rates
* *European subscriptions must be remitted in British currency*

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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:—

Jan. 10 **"Materials from the Aeronautical Point of View," by Dr. Aitchison and Mr. North, before R.Ae.S.**
Jan. 24 **"Fabric and Dopes," by Dr. Ramsbottom, before R.Ae.S.**
Feb. 7 **"Airmanship at Sea," by Sqd.-Ldr. Maycock, O.B.E., R.A.F., before R.Ae.S.**
Feb. 21 **"Aerial Photography and Survey," by Mr. H. Hamshaw Thomas, before R.Ae.S.**
Mar. 1 **French Aero Engine Competition.**
Mar. 6 **"Sound Detection," by Major Tucker, before R.Ae.S.**
Mar. 20 **"The Report of the Aeronautical Research Committee's Panel on Scale Effect," by Capt. W. S. Farren.**
April 3 **"The British Aviation Mission to the Imperial Japanese Navy," by Colonel the Master of Sempill, before R.Ae.S.**

EDITORIAL COMMENT.



THE new Air Navigation Regulations were issued by the Air Ministry early this week, and appear to contain certain modifications and changes on various points. Time has not permitted a thorough perusal of the Regulations, but a few outstanding items may be noted. Fuller particulars and further comment will be published in next week's FLIGHT. The principal clause of the Order refers to the inclusion of all British aircraft registered in Great Britain and Northern Ireland wherever such aircraft may be, and to foreign aircraft when in or over Great Britain and Northern Ireland. A further extension of the Order provides that an aircraft cannot avoid liability for compliance with the Order because it is not registered. As in previous years, the Regulations provide for the machines of countries not signatories to the International Air Convention being allowed to fly over this country under special international agreements.

Air Navigation Order

A revision of the previous rules is found in the section dealing with log books. Whereas it has hitherto been necessary for the aircraft and engine log books to be carried on the machine, this will not be required in the future, but the journey log book must be carried and must contain the airworthiness certificate of the machine. So far as we have been able to discover in the limited time at our disposal, no special provision has yet been made for the inclusion of rules applying to light aeroplanes. On the contrary, power is taken to require proof of medical fitness and recent flying experience from candidates for private pilot's licences. This is a point to which we hope to return in more detail next week.

Evidently with an expansion of the existing air services in view, the Order stipulates that in future aircraft carrying more than 10 passengers, and making a continuous flight between two points more than 310 miles apart over land, or a night flight, or a flight between two points more than 124 miles apart over the sea, shall carry a navigator. In view of the number of things the pilot of a modern aeroplane has

to look after, quite apart from the actual handling of his machine, this clause can scarcely be taken exception to, although it may appear to impose an extra "non-paying" load on the machine. As a matter of fact, as time goes on and the journeys regularly undertaken increase in length, some such provision would appear to have become a reasonable safeguard.

The rules of the air are laid down very fully in the Orders, and have been elaborated in certain sections to provide against collision between aircraft using a regular route, such as that between London and Paris, for instance. The Directions, dry and official as they are, are not entirely without their amusing side. Thus, in line 3 of sub-paragraph 55 of the principal Directions, the words "flying machines carrying passengers or goods for hire or reward" are substituted for the words "passenger or goods flying machines." But why "flying machines" at all The term does not seem to be in keeping with modern progress and rather conjures up pictures of weird and wonderful contraptions of the 1909 or 1910 vintage.

* * *

Water-Cooled Aero Engines

Elsewhere in this issue we publish a summary of a paper on "Water-cooled Aero Engines," read by Mr. Rowledge before the Institute of Automobile Engineers. The paper was evidently written more with a view to putting before a body not intimately connected with aviation the problems and practice of aero-engine work than with a view to introduce innovations and outstanding problems to aeronautical engineers. Nevertheless, the paper contained a good deal that was of interest even to those in close touch with aero-engine design, and particularly the lecturer's remarks concerning variable pitch airscrews or the, probably somewhat easier, alternative of a two-speed gear. Frankly, we think that the two-speed gear is long overdue, and we have the authority of a man of Mr. Rowledge's experience for it that the problem of such a gear does not appear to present any very great difficulties. Mr. Fairey referred to the subject in his paper on seaplanes before the Air Conference, showing how such a gear might be of very considerable value for seaplane work. For aeroplanes, also, the gear would have many advantages, both on commercial and military machines, and it is to be hoped that a satisfactory gear will soon be evolved.

Another point to which Mr. Rowledge called attention was the blower, and he took the view that, on balance, a blower driven by the engine, or, in the case of multi-engined aircraft, by a separate power plant, was to be preferred to the exhaust-driven turbine developed abroad, mainly in France and the United States. The subject is one worthy of very serious attention, and, as Mr. Rowledge pointed out, is one which appears to have been badly neglected since 1918, when the German experiments ceased. In some of the German "Riesenflugzeuge" a blower driven by a separate engine was employed, and, apparently, gave very good results.

While it is understood that Mr. Rowledge was out to put the case for the water-cooled engine as strongly as possible, it does seem to us that he gave the air-cooled engine perhaps rather less than its due. Although few will quarrel with Mr. Rowledge over the points he mentioned where the water-cooled scores, there are certain advantages of the air-cooled which might have been given more prominence, but perhaps later on a paper will be read by an exponent of the air-cooled engine, stating the several advantages of this type.

* * *

172 m.p.g.

In our Light 'Plane and Glider Notes this week we publish a letter from Mr. W. S. Shackleton, referring to the Solex prize for light 'planes, which will be given to the first French pilot who flies from Paris to Rouen using only one kilogramme of fuel. The prize itself is of comparatively little interest to British constructors, as it is reserved for French pilots, but Mr. Shackleton's estimates of the mileage possible are of the very greatest interest. He arrives at the conclusion that a mileage of 172 m.p.g. should be just about possible, and his reasons appear quite sound. While we have no hopes of any practical machine being able to reduce petrol consumption to such a point in regular ordinary flying, the figures do indicate that extremely good economy may be hoped for in the case of light 'planes, a fact that will be of considerable value to the owner of such a machine. Incidentally, the astoundingly low consumption seems to show the possibility of very long non-stop flights by machines of this type. Such flights are of immense importance as a form of propaganda, and we think it would be well worth the expense of British aircraft firms to undertake, in the spring, when weather conditions are better, flights such as London to Malta. We have referred to this subject previously, and the estimates given by Mr. Shackleton confirm the possibility of such long flights being successfully undertaken. It seems to be mainly a question of engine reliability, and as one engine at least, the Bristol "Cherub," has completed a 50-hours non-stop run, it is permissible to hope that a London-Malta flight will soon be within the bounds of practical politics.

Early Days at Brooklands

LEST we should forget that it was by the earliest enthusiasts that the foundation was laid upon which, many years later, British supremacy in the War was built up, and British pre-eminence in design was based, there has long been need of a book on the work of the early experimenters; not a dry book, be it said, giving dates and facts and figures only, but conveying nothing of the atmosphere and spirit in which that early work was being carried out. Rather do we want a book by one intimately connected with, and actually taking part in, the struggle. Some day such a book will perhaps be published. The number of men qualified to write it is not a large one. In the meantime, a very excellent start is being made with a lecture by Mr. Howard Flanders, before the Institution of Aeronautical Engineers, at the Engineers' Club, Coventry Street, W., at 6.30 p.m., on January 11. Mr. Flanders was himself one of the Brooklands experimenters of the early days, and before starting out for himself he worked with Mr. A. V. Roe on Lea Marshes. He is, therefore, singularly qualified to speak on the subject which he has chosen: "Reminiscences of the Early Days of Aviation at Brooklands."

Mr. Flanders, we believe, proposes to deal with that early piece of history from memory only, and his lecture may, therefore, be expected to be very much in the spirit which we have indicated as desirable for a book on early aviation. It is to be hoped other early British pioneers will be present so as to add to the lecture their own personal recollections, and all who would appreciate the development of British aviation should make a point of attending the meeting. Tickets are not required, and all who are genuinely interested will be welcomed, up to the capacity of the lecture hall.

THE COX-KLEMIN C.K.2 TRAINING BIPLANE

A MEDIUM-SIZED tractor biplane for training purposes and possessing several interesting features has recently been produced by the Cox-Klemin Aircraft Corporation, College Point, L.I., for the U.S. Army Air Service. In this machine a tandem seating arrangement, located aft of the wings, is employed for both the pilot and the pupil. This not only facilitates instruction, but permits easy access to the cockpit, and also permits leaving the same with a parachute without interference with struts or wires.

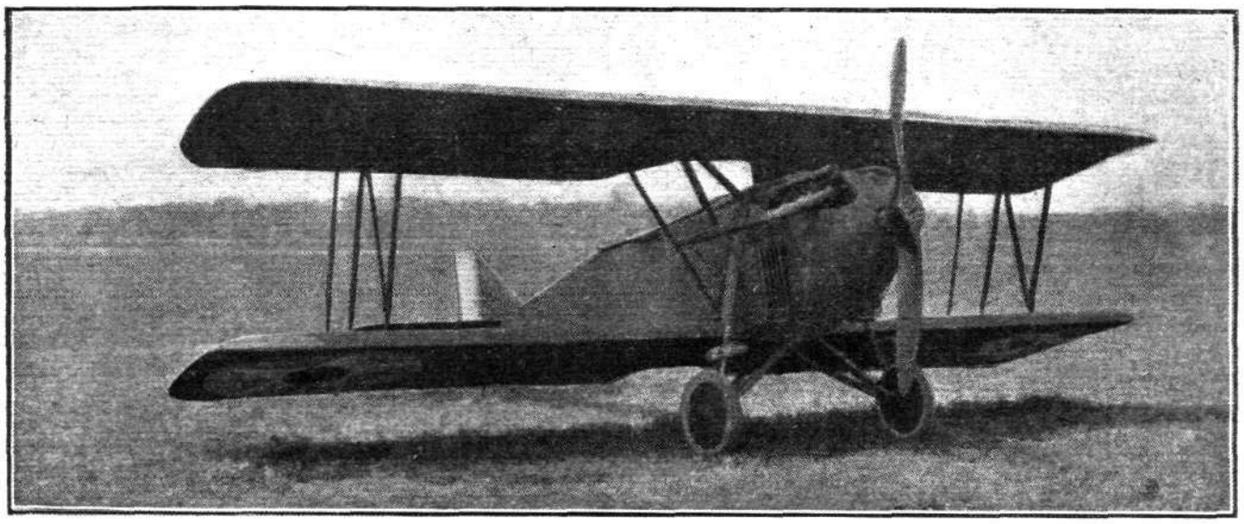
The fuselage is of metal construction throughout, steel tube longerons and struts, with wire bracing, being employed. No welding is employed in its construction. A modified Fokker-type truss is employed for supporting the centre of the top plane from the fuselage. It differs from the original Fokker arrangement in that, whereas there are four struts in each truss in the Fokker, in the C.K.2 there are but three.

The stabiliser is adjustable when the machine is on the ground.

The instruments are located in the centre of the top plane, in which position they are clearly visible to the pilot and pupil at all times. The petrol tanks are mounted between the spars of the upper plane, 5 ft. out from the fuselage on each side of the machine. This arrangement of the tanks minimises the risk of fire in the event of a crash, and also provides a good head for gravity feed.

A Wright model E, 190 h.p. eight-cylinder, water-cooled V-engine is employed, being mounted in the neatly rounded-off nose of the fuselage. The radiators are mounted on the sides of the fuselage, and are fitted with shutters operated from the cockpit.

The landing gear is of the " no-axle " type, the wheels being carried on two V's extending outwards from the bottom of the fuselage, and the shocks being taken by an absorber mounted on a vertical strut running from the wheel up to the side of the fuselage.



THE COX-KLEMIN C.K.2 : A two-seater side-by-side training 'plane built for the U.S. Army Air Service. It is fitted with a Wright model E 190 h.p. engine.

Both upper and lower wings are continuous from tip to tip, and are separated by a pair of N-struts. U.S.A.27 wing section is employed, which, being a thick section, permits the use of thick spars suitable for the Fokker type bracing. The spars are built up with spruce flanges, top and bottom, tapering from the centre to the tips, with plywood side members. Built-in spruce compression members and wire bracing are used in the construction of the wing frame work. Ailerons are fitted to both upper and lower planes, the cables running through the lower wing and being connected to the control shaft lever by a bolt. When the wings are removed the controls are detached by simply removing this bolt, and the adjustment of the cables is not disturbed. The aileron cables are attached to a T-crank in the wing, which is connected to the aileron by a steel tube with an adjusting screw ; the upper and lower ailerons are connected by an adjustable steel strut. The controls are of the stick type, and

In conclusion it should be noted that this machine can be assembled very easily and quickly, as there are no bracing wires to fix or other adjustments to be made on the field.

The principal characteristics of the C.K.2 are :—

Span	29 ft.
Chord	5 ft. 6 ins.
Gap	5 ft. 2 ins.
Stagger	2 ft.
Wing area	293 sq. ft.
Wing section	U.S.A.27.
Weight laden	2,400 lbs.
Loading per h.p.	12·62 lbs.
Loading per sq. ft.	8·18 lbs.
Speed range	47-125 m.p.h.

THE LATE COLONEL TEMPLER

IT is with regret we have to announce the death of a pioneer of military aviation in Colonel James L. B. Templer, who died on January 2 at Laughton Grange, Lewes, aged 78.

Colonel Templer will best be remembered for his energetic pioneer work—in the face of much official opposition—in connection with military ballooning and man-lifting kites. It was in the "seventies," when he was a captain in the King's Royal Rifles, that he started his work on ballooning. He formed the first Army School of Ballooning, and made many successful ascents from time to time, during manœuvres, etc. He formed a balloon corps, of three balloons, which was sent out with Sir Charles Warren's Bechuanaland expedition, and took three balloons himself to the Sudan in 1885, where he was mentioned in despatches for work done at Hasheen.

During the South African War he was Director of Steam Road Transport. Mechanical road transport also owes much to Colonel Templer, for he was responsible very largely for its development for Army use. He despatched four balloon sections to South Africa, which did remarkably well.

Colonel Templer was responsible for many improvements in connection with balloons and airships. The application of goldbeaters' skin for balloon and airship envelopes, hydrogen production and filling were two important achievements of his. He was largely responsible for the first British Army airship, " Nulli Secundus," in which he flew over London, accompanied by S. F. Cody and Major-General Sir J.. E. Capper (then Colonel). About this time he was Superintendent of the Army Balloon Factory at Farnborough.

Colonel Templer was the son of John Templer, a Master of the old Court of Exchequer. He was born in 1846, and was educated at Harrow and at Trinity College, Cambridge. In 1889 he married Florence Henrietta, third daughter of the late Mr. J. S. Gilliat, M.P., formerly Governor of the Bank of England, and had a daughter.

LIGHT 'PLANE AND GLIDER NOTES

Those wishing to get in touch with others interested in matters relating to gliding and the construction of gliders are invited to write to the Editor of FLIGHT, *who will be pleased to publish such communications on this page, in order to bring together those who would like to co-operate, either in forming gliding clubs or in private collaboration.*

WITH reference to our remarks last week on the Solex prize for flying from Paris to Rouen, using only 1 kilogramme of fuel and oil, we have received from Mr. W. S. Shackleton, designer of the A.N.E.C. monoplanes, the following notes which were, incidentally, written before Mr. Shackleton saw last week's issue of FLIGHT. The letter runs as follows :—

" An interesting announcement appears in the current issue of that excellent little journal *Les Ailes*, of an offer of 50,000 francs made by the Société du Carburateur Solex for the first non-stop flight between Paris and Rouen, using not more than 1 kg. of petrol and oil. This calls for a flight of nearly 56 miles on, say, 2·3 pints of petrol—or at the rate of 194 miles per gallon.

* * *

" Is this formidable performance possible ? In the light of the recent trials at Lympne, it would certainly appear to be asking too much, but it must be remembered that even in calm weather the triangular Lympne course reduces the actual distance flown to a greater extent than a point-to-point contest, and it is fairly certain that the ' Wren,' for example, would be capable of doing 125 m.p.g. under favourable conditions. Again, with a triangular course any ordinary wind increases the petrol consumption considerably, particularly affecting the slower machines. On a point-to-point course like the Paris-Rouen with a favourable wind the exact reverse is true. The slower machines would be helped proportionately more than the faster ones, and it is conceivable that the actual m.p.g. might be doubled.

* * *

" IT is interesting to form some idea of what it should be possible to obtain in the way of m.p.g. in still air. It would be difficult, for example, with our present knowledge to produce a machine having a better value of K_L/K_D than say 17, or one weighing less than 400 lbs. in flying trim. Such a machine would probably have an absolute lift coefficient at the best gliding angle of about 0·36, and with a wing loading of 3 lbs./sq. ft. would maintain level flight at that angle of attack at a speed of 60 ft./sec., or 41 m.p.h.

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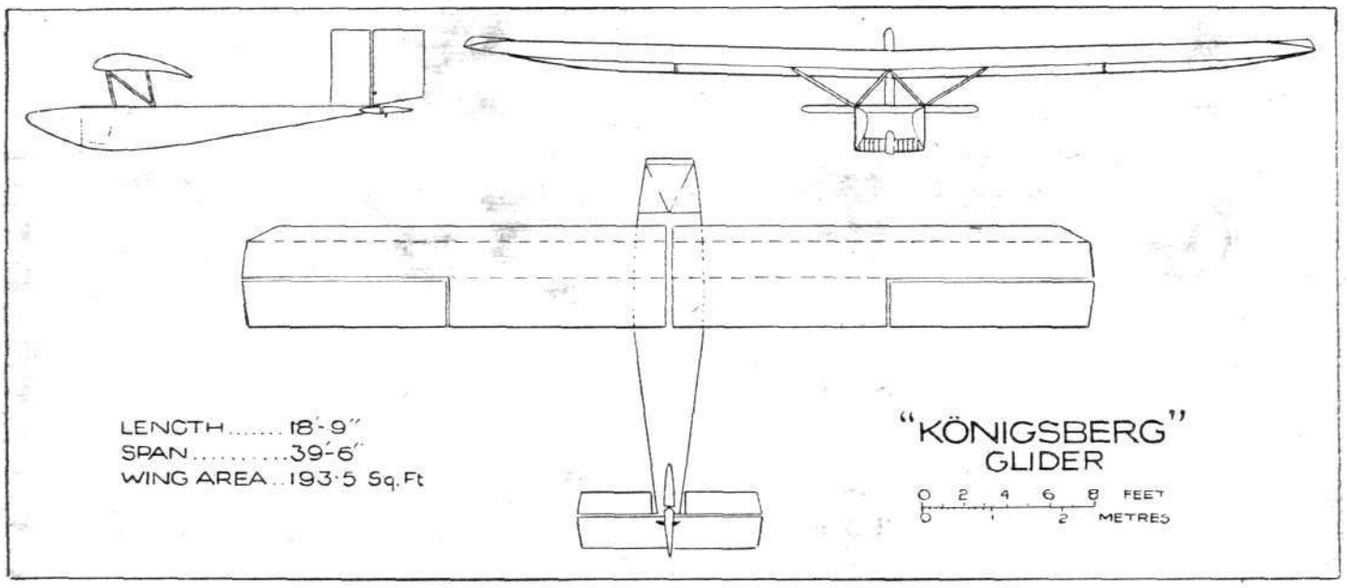
" THE drag at this speed would be 23·5 lbs., and thrust horse-power required just over 2·5 h.p. With an oversize propeller designed to limit the maximum engine r.p.m. to the lowest possible, the engine should not be called upon to develop more than 3·66 h.p. at 41 m.p.h. The petrol consumption can be brought down to ·52 pint per b.h.p./hour on an engine like the 698 c.c. Blackburne, which figure is remarkable in view of the necessarily lower mechanical efficiency of the small engine. The petrol consumption, therefore, works out at 3·66 × ·52 = 1·9 pints per 41 miles, or, with the allowance of 2·3 pints, 49·6 miles, which is only about 6 miles short of the required distance. With a following wind it should, therefore, be possible to win the Solex prize.

* * *

" THE above figures indicate that it should be possible to fly 172 miles on a gallon of fuel. *The two factors tending towards economical flight are a good gliding angle and low weight. Engine size, within limits, has little bearing on the question.*"

* * *

THE above remarks are of more than usual interest, especially those relating to the two main factors making for economy, and the statement that engine size has little to do with economy, within limits. As the finishing sentence sums up the situation in a few words, we have printed it in italics. These, it should be pointed out, are ours and not Mr. Shackleton's. It will probably come as a revelation to most people that a mileage of 172 miles per gallon is considered possible by the designer of one of the most successful light 'planes at Lympne, and the concluding statement—that, within limits, engine size has little effect—seems to be borne out by the Lympne trials, the A.N.E.C. monoplane, with 698 c.c. Blackburne engine, doing as good mileage as the " Wren " with 400 c.c. engine. Incidentally, the fact that light 'planes are able to cover great distances on a small quantity of fuel, although, perhaps, of little practical value, is of interest inasmuch as it indicates that very long non-stop flights, say, of 2,000 miles or so, should be possible provided the engine used will stand up to the work.



THE MONOPLANE GLIDER "KOENIGSBERG" : General arrangement drawings, to scale. The machine is designed for alighting on the water.

* * *

LIEUT. THORET, who, as previously recorded in these columns, has been on a mission to Czecho-Slovakia, has now returned to France, and has succeeded in discovering a site suitable for gliding. On December 19 he glided for 2 hrs. 7 mins. over the slope of the Zibrica mountain, whose greatest height is 618 metres (just over 2,000 ft.). The machine used was a Brandenburg with fairly heavy wing loading. Thoret even succeeded in making a complete circuit. While on his visit to Czecho-Slovakia Thoret has taught several pilots to fly the Dewoitine light monoplane.

* * *

THE *Tour de France* by light aeroplanes, which will take place during the coming summer, is still being considered by the French authorities, and it is stated that the final rules and regulations will not be published for another fortnight or so. In the meantime it has been decided that the machines, before being allowed to compete, must obtain an airworthiness certificate, a special form of which is to be issued. It is believed that sand loading tests to destruction of the wings will be demanded, and that the fuselage must have a factor of safety of at least 5, while the engines used must have passed an acceptance run on the test bench of 4 hours, ½ hour of

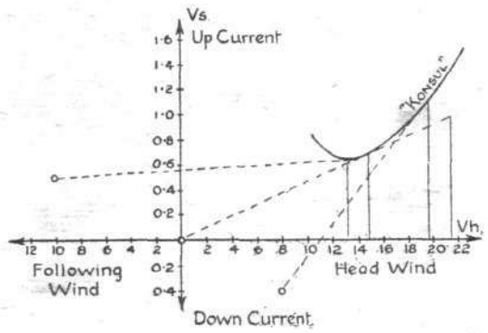
which at full power and the remaining 3½ hours at 90 per cent. of stated full power.

* * *

THE *Tour de France* is an international event, and it is hoped that several British light 'planes will take part. Single-seaters as well as two-seaters will be admitted, so that if desired both last year's Lympne machines and those designed and built for the British competitions of this year can be entered.

* * *

THE Carley light monoplane has been making flights both at le Bourget and at Villacoublay. At the latter aerodrome it was demonstrated before the *Section Technique*. It is rumoured that Raparlier intends to have a try for the light 'plane altitude "record." It would seem, however, that the high wing loading of this machine is not particularly favourable for altitude work. The machine is "incessantly expected" at Croydon.



Curve of L/D ratios of the Darmstadt "Konsul."

* * *

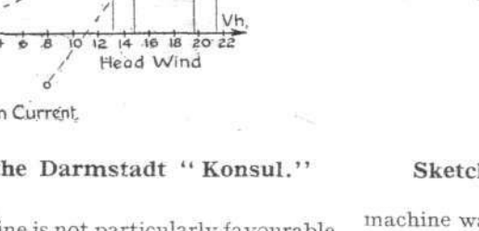
LAST week we referred briefly to the monoplane glider "Königsberg," designed to be able to alight on the sea, as it was intended for use along the sand dunes separating the Kurisches Haff from the Baltic, and there was always considerable risk of the pilot being forced to come down in the sea. At first it was intended to make the fuselage in the form of a stepped hull, so as to enable the machine to be towed off the sea, but later it was decided to make a plain hull capable of riding on the water for some considerable time without sinking. This week we are able to give an outline general arrangement drawing of this machine, and a few supplementary particulars.

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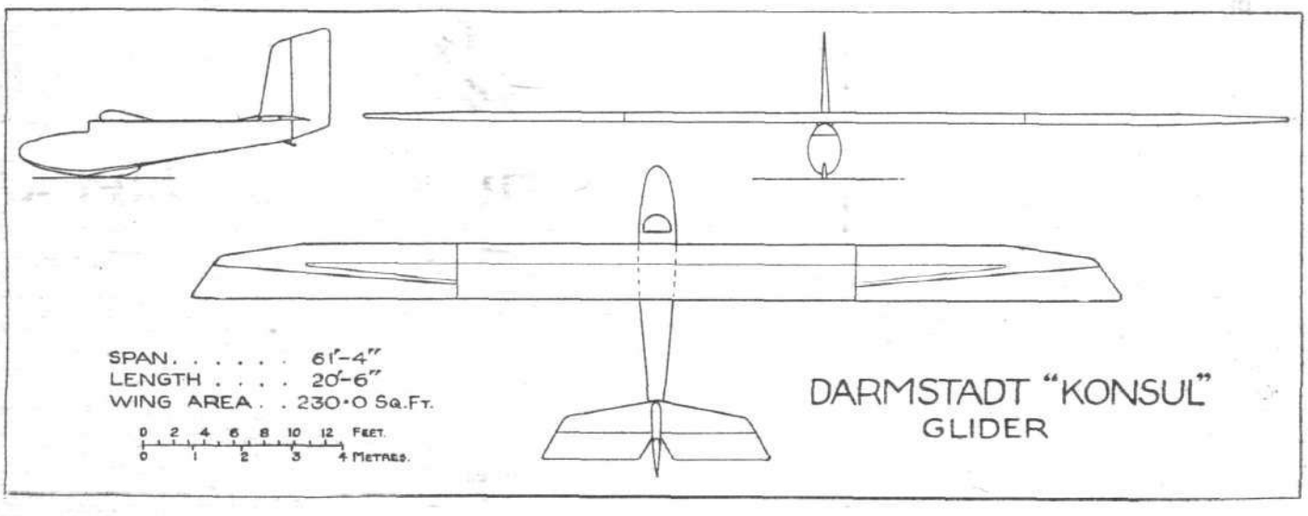
THE "Königsberg" was designed and built by Herr Kurt Peyean in his spare time, and mostly at his private house. As the accompanying general arrangement drawings indicate, the machine is a normal monoplane, with the exception that the wing is raised a considerable distance above the fuselage or hull, being mounted on struts. The wing section used is the Göttingen No. 441. The construction of the wing is the usual, with two spars and internal strut and wire drag bracing. The wing is of approximately rectangular plan form, but is thinned down in depth towards the tips.

* * *

THE fuselage or hull is a girder structure, with spruce longerons and struts, and wire bracing. Water-tightness is provided by the fabric covering only, the bottom covering being double thickness. The machine has rested on the water for an hour without more than a very small quantity finding its way inside. After the Rossitten glider meeting the machine was left out in the open, often in the rain, but when taken to the Rhön meeting later the factor of safety was still found to be 6. The weight of the machine empty is 100 kgs. (220 lbs.), and as the wing area is 18 sq. m. (194 sq. ft.) the wing loading with pilot on board is approximately 2 lbs./sq. ft. In the Rhön the machine made only three flights, when further work had to be suspended owing to lack of capital.



Sketch of the Darmstadt "Konsul" in flight.



THE DARMSTADT GLIDER "KONSUL": General arrangement drawings, to scale. The aspect ratio is very high, 15.58.

ONE of the most interesting of the machines which took part in this year's Rhön competitions was the Darmstadt "Konsul," on which Botsch covered a distance of 12 miles. By the courtesy of our German contemporary *Flugsport* we are able this week to publish the general arrangement drawings of this machine, and also a curve of gliding angles. The machine was designed for long-distance flights, as the Darmstadt students considered that the problem of soaring in an up-current had already been solved, the quality required being low rate of descent. For long-distance work, however, it was necessary that the machine should be able to cover the greatest possible distance for a given loss of height. High L/D ratio, or, in other words, a good gliding angle in still air, was wanted, and in order to cover a good distance under varying wind conditions a good gliding angle over a wide range of speeds was required. The result of these considerations was that the designers decided to "go the limit" on

aspect ratio, and from the drawings it will be seen that this appears to have been done, the wing span being no less than 18·7 m. (61 ft. 4 ins.), while the chord is 1·2 m. (3 ft. 11 ins.), giving an aspect ratio of 15·6. It is a matter for surprise that such a wing structure has been possible for a reasonable weight, and that sufficient controllability has been obtained.

* * *

FROM the accompanying curve the gliding angle of the Darmstadt "Konsul" can be ascertained under varying conditions. The curve indicates that normally, *i.e.*, in still air, the "Konsul" has an optimum gliding angle of 1 in 21·4, at a speed of 14·8 m. per second (48·5 ft./sec. = 33 m.p.h.). This figure is, of course, extraordinarily good, and probably marks the maximum ever attained by any glider. For the "Konsul" it is found that when flying with a following wind of 10 m./sec. (32·8 ft./sec. = 22·3 m.p.h.), and in a rising current of ·5 m. per sec., the best gliding angle is something like 1 in 160 and occurs at a speed of 13·2 m./sec. The worst condition is, of course, gliding against a wind and in a down current. If the head wind is blowing at 8 m./sec. and the down current is ·4 m./sec., the best gliding angle is 1 in 10·6, at a speed of 20 m./sec. (44·5 m.p.h.).

* * *

THE construction of the "Konsul" is of special interest, as it might have been thought well-nigh impossible to build such a wing with sufficient rigidity against torsional stresses. The manner in which it has been done reflects credit on the designers. The monoplane wing, which is in three sections, of which the centre section is of 8 m. (26 ft. 2 ins.) span, is built up on a single spar, reinforced against torsion by covering the entire leading edge with three-ply wood. In the centre section the spar is of box section, while in the ends an I-section spar is used. As will be seen, the wing does not taper greatly in chord, but it does taper considerably in thickness, and the angle of incidence diminishes towards the tips so as to get a better load distribution and increase the aileron effect.

* * *

AN interesting feature of the "Konsul" is the interconnection of rudder and ailerons. This has been employed in order to increase the controllability, which, as a matter of fact, is reported to be quite satisfactory. For small rudder angles the ailerons are not affected, but once the rudder exceeds a certain angle the ailerons are automatically brought into play to assist the turn. Only in this way could controllability be obtained with such large span and comparatively small rudder leverage.

* * *

THE aileron control is so arranged that, when right rudder is put on, the right aileron moves up through a considerable angle, whereas the left aileron moves down through a much smaller angle. In other words, the action of the ailerons of the Darmstadt "Konsul" is very similar in principle to the de Havilland patented differential aileron control, which, for one thing, forms a convenient form of aileron balance, and also has the advantage of reducing the tendency to swing the machine into a spin, owing to the great drag on the lower aileron set up when no differential movement is provided. In the glider, however, the ailerons, in addition to their differential action, are connected to the rudder, which is not, of course, the case in the de Havilland system.

* * *

THE fuselage is of oval section, with sharp edges top and bottom. It is covered with three-ply, and the undercarriage consists of a single central skid, enclosed in fabric and sprung by rubber cords. The "Konsul" is somewhat faster than the designers had expected, partly because the weight was greater than had been anticipated, and partly, it is thought, because the wing fabric sagged considerably between the ribs, the section being heavily cambered, and therefore the value of K_L somewhat smaller than that of the sections upon which the design estimates were based. Nevertheless, we think the Akademische Fliegergruppe Darmstadt deserve the very greatest credit for their machine, especially when it is remembered that financial difficulties were very great indeed. We wish to goodness there was more of the Rhön spirit in this country.

Personals.

Married

Flying Officer JOHN MALCOLM GLAISHER, D.F.C., R.A.F., son of the late Henry Glaisher and Mrs. Glaisher, of Blackheath, was married on December 27, at the Chapel Royal, Savoy, to NORA GLADYS EDITH LEAH CLELAND, daughter of the late HUBERT DAVIES, of Johannesburg.

THROWER HERRING, R.A.F., son of Mr. and Mrs. Herring, late of "Petra," Weston-super-Mare, was married on December 22, at All Saints' Church, Weston-super-Mare, to GLADYS PRETORIA HIND, daughter of Mrs. Hind, of "Woodcliffe," Weston-super-Mare.

Flight-Lieut. H. V. PENDAVIS, D.S.O., son of the Ven. Archdeacon and Mrs. W. Pendavis, of Fringford, Oxon., was married on December 22, at All Souls', Langham Place, to RUTH MARGARET, daughter of Mr. and Mrs. CHARLES C. CULROSS, of Wendover, Bucks.

FREDERICK PHILLIPS RAYNHAM, only son of the late James Kistruck Raynham, of Hessett, Suffolk, and Mrs. Raynham, Elm Bank, Woking, was married on December 24, at St. Mary of Bethany, Woking, to MARJORY PURVES MACPHERSON, daughter of the late John Ross Macpherson and Mrs. Keane, Oaklands, Woking.

To be Married

A marriage has been arranged, and will shortly take place, between Mr. FREDERIC ALAN PUMPHREY, R.A.F., third son of Mr. and Mrs. Frederic Pumphrey, of Vancouver, B.C., and MURIEL, youngest daughter of the late T. E. PUMPHREY, J.P., and Mrs. PUMPHREY, of Mayfield, Sunderland.

The engagement is announced between Capt. T. G. THORNTON, M.C., D.F.C., of 9D, Oxford and Cambridge Mansions, N.W. 1, and CATHARINE ELEANOR MARY, second daughter of Mr. and Mrs. J. H. BARTLETT, of 27, Redcliffe Gardens, S.W. 10. The marriage will take place on February 14 at the Servite Church.

Death

Squadron Leader ERIC LEWIS CONRAN, M.C., R.A.F., and late 21st Lancers, who died on January 6 at a nursing home in London, following an operation, was the only son of Mr. and Mrs. Henry L. Conran. His age was 36.

The death is announced of Flight-Lieut. ALBERT EDWARD GENDLE, aged 36, who was attacked by Arabs on the outskirts of Baghdad on December 7. Before the War Flight-Lieut. Gendle was with the South Kensington Meteorological Department, and was selected to form the various observation stations of the R.N.A.S. throughout the British Isles. Later he went to the Air Ministry, where he carried out the meteorological surveys and observations in connection with the transatlantic flights of the "R" type airships and of aeroplanes.

JOHN GWYNNE HOWELL, M.C., late Major, R.A.F., of 9, the Paragon, Blackheath, S.E.3, who died on December 19, aged 32, was the only son of Mr. and Mrs. Howell, of Castlemead Manorbier, Pembrokeshire.

Item

Lieut. Aviateur CHEVALIER COPPENS, Air Attaché at the Belgian Embassy, has returned to London from the Continent.

Captain SILVIO SCARONI, Air Attaché at the Italian Embassy, has returned to London from Italy.

▣ ▣

Commander Hunsaker in England

THE appointment of Commander Jerome C. Hunsaker to Assistant Naval Attaché at the American Embassy, London, will be welcomed by all connected with aviation. Commander Hunsaker needs no introduction to readers of FLIGHT, to whom his extremely useful work in America will be well known. Commander Hunsaker's post at the Bureau of Aeronautics, Washington, will be filled by Commander Holden C. Richardson, U.S.N., who will also be familiar to our readers. It will be recollected that at the Air Conference at the Guildhall Commander Richardson had some very interesting things to say about seaplane hulls and floats.

French Record over 500 km.

ADJUTANT FOINY, flying over the circuit Tours-Chartres-Tours, has succeeded in establishing a new French record over 500 km. His time was 2 hrs. 27 mins. 47 secs., giving an average speed of 203 km. (126 miles) per hour. The world's record over 500 km. is at present held by the American aviator, Lieut. Pearson, whose speed over the 500 km. course was 272 km. (168·5 miles) per hour. Foiny intends to attempt to beat the American record which was established on March 29, 1923.

FLIGHT
THE AIRCRAFT ENGINEER AIRSHIPS

THE USE OF HELIUM IN DIRIGIBLES

IN view of the recent regrettable loss of the French (ex-German) airship *Dixmude*, which, as far as can be ascertained, was destroyed by fire, we publish below (through the courtesy of our American contemporary *International Aeronautics*) an article on "The Use of Helium in Dirigibles," by Col. G. Arthur Crocco.

One of the biggest problems of the airship is that of fire, therefore the following notes on helium, which, owing to its non-inflammable properties, is probably a solution to this vital question of fire, should be of special interest just now.

About 30,000 cubic metres per day of helium have been extracted in the United States with a total expenditure of $70,000 for the installations needed for this purpose. Of this total amount about 10,000 cubic metres were easily obtained, the other twenty thousand were more laboriously extracted. Taking twenty years as the average life of a helium producing pit, spreading over this period of time the cost of installation and adding to it the production expenses, we obtain a minimum cost of $2 per cubic metre of compressed helium, while the probable annual production is three million cubic metres.

Aside from the use of helium in military dirigibles, when the matter of cost would be relatively unimportant, let us consider whether it would be feasible to use this gas in commercial dirigibles, in spite of the fact that its cost is about 15 times the cost of hydrogen. Let us calculate the annual gas consumption of a dirigible and the total tonnage of airships that can be supplied with the limited American production of helium.

The consumption of gas of an airship is due to: (*a*) diffusion; (*b*) washing of gas needed in order to maintain the necessary percentage of purity; (*c*) navigation losses. Of the three, the last one is the most important at the present time.

Navigation Losses.—Theoretically, an airship must lose during a trip about one cubic metre of gas for every kilogram of fuel burned. Practically, a number of other factors modify this rather simple rule, such as: losses when leaving the ground, differences of temperatures between air and gas, eventual external loads on the envelope, dynamic sustentation, losses when landing, etc. A good pilot who knows how to take advantage of changing meteorologic conditions can make a trip without wasting any large amount of gas; this, however, cannot be depended upon in commercial operation of airships, which must follow a given route at a given altitude, and must leave the ground and land according to schedule.

If we figure the navigation losses on the basis of one cubic metre of gas per every kilogram of fuel burned, in the case of long trips and intensive operation (about 4,000 hours per year), we find that an airship of about 100,000 cubic metres capacity, equipped with 3,600 h.p. power-plants, operating at half-power, and burning 500 kg. of fuel per hour, in one year it will have used up 2,000,000 cubic metres of gas, or twenty times the volume of the airship. On this basis, the total annual production of American helium would be absorbed by the operation of one single airship, and the cost of operation would be entirely too high for commercial purposes.

Under these conditions, even hydrogen would be too expensive to use and furthermore a practical autonomy of dirigibles could never be obtained until a method of compensating the losses of weight due to the fuel burned during the navigation had been devised. In principle this problem has been solved, and the navigation losses of gas can be considered as being entirely avoidable.

Diffusion Losses.—Not much data is available yet on the losses of helium due to diffusion through the various materials out of which gas bags of dirigibles are made. Experiments have proved so far that for the same materials used, the diffusion losses of hydrogen are double those of helium. Experiments made at the Aeronautical Institute of Rome (Rend. I.A., Zallo, February 1, 1921) with Italian rubberised materials used for gas bags with a weight of p of rubber (between 80 and 160 grams per square metre), at ordinary temperatures, gave a loss of helium in litres per day, which can be very closely expressed by the formula $520/p$. The same losses with hydrogen were expressed with the formula $1000/p$.

Experiments made by the National Advisory Committee for Aeronautics in 1915 (see report No. 6) failed to verify the law of proportionality existing between the losses of gas and p that the Italian experiments seem to indicate, but they proved nevertheless that these losses can be greatly reduced, even at high temperatures, if specially treated materials are used.

It does not seem to be very far from the present-day reality to figure on a diffusion loss of three litres of helium per every twenty-four hours in a dirigible of the cubic content given above. The surface of the gas bag of a 100,000 cubic metres dirigible is about 18,000 square metres and the annual diffusion losses of a dirigible of this size would be 19,440 cubic metres, or just about 20 per cent. of the total volume of gas. In the case of larger dirigibles this percentage is still smaller, due to the smaller ratio existing between surface and volume of the gas bag and, also, due to the larger value of p in the formula given above. (See Bulletin No. 10, 1922, I.A., Rome.)

Washing Losses.—At the present time the amount of gas that must be supplied for offsetting the navigation losses is sufficiently large for insuring the desired degree of purity of the gas. When, however, these losses will be entirely eliminated, a daily washing of the gas bag will be absolutely necessary. For every cubic metre of helium which escapes through the envelope about 400 litres of air will pass through the envelope into the gas bag and must be separated from the helium in order to maintain the desired degree of purity of this gas. If we call a the degree of purity which must be maintained in the gas and v the percentage loss of gas due to diffusion in a unit of time, in order to separate from the gas the quantity of air: $0{\cdot}4v$ which has penetrated into the gas bag in the same unit of time, we must substitute to a percentage volume of impure helium expressed by: $\frac{0{\cdot}4v}{1-a}$, an equal volume of pure helium in the same unit of time.

For instance, if we want to maintain a degree of purity of the helium $a = {\cdot}96$ and the diffusion losses are $v = {\cdot}20$ per year, the volume of pure helium that in one year must replace an equal volume of impure helium is twice the volume of the gas bag.

Fortunately this last cause of loss of helium can be entirely eliminated through process of purification of the gas mixture extracted from the gas bag, from which the remaining pure helium can be recuperated.

In conclusion, of the three causes of losses that we have here investigated: *Navigation Losses, Diffusion Losses and Losses Due to the Necessary Washing* of the gas, which are in the ratio of 100, 10 and 1 respectively, only diffusion losses, amounting to 20 per cent. per year of the total volume of the gas, is irreparably lost.

Such being the case, we find that the present supply of American helium is sufficiently large to take care of a fleet of 150 airships of 100,000 cubic metres each, and the cost of helium needed for repairing the diffusion losses is only one-fifth of the original cost of the helium needed for filling up the gas bag. Under these conditions the helium of a dirigible can be considered as a part of the equipment which is depreciated after five years of operation, and, therefore, the commercial operation of helium-filled dirigibles in the future becomes a practical possibility.






Two Calendars for 1924

WE wish to acknowledge the receipt of two artistic calendars for 1924 from two of our pioneer aviation houses. One of these, from the Blackburne Aircraft Company, of Olympia, Leeds, consists—in addition, of course, to the "tear-off months of the year"—of a two-colour picture depicting a Blackburne torpedo 'plane flying over the sea at sunset (or sunrise ?), and in the act of dropping its deadly messenger. Our second calendar is from our old friends Short Bros., of Rochester and Belford, and bears a really delightful reproduction in colours of a water-colour drawing by Donald Maxwell, showing an old-world street with a new-world "Railless" electric car threading its way through the traffic, whilst the Short "Silver Streak" biplane flies overhead. The manufacture of "Railless" electric cars—that is, a steerable electric "tram" with overhead power wires but without the rails in the roadway—forms an important branch of Short Bros.

OVER THE BALKANS AND SOUTH RUSSIA*

By H. A. JONES, M.C.

THIS volume by H. A. Jones, recently published, is frankly a brief history of the work in the War of No. 47 Squadron, one of the permanent squadrons, and of the 16th Wing. As a record of magnificent services to the Empire by a section of the R.A.F., this book is of great value. From its pages can be visualised in a small degree the wonderful enthusiasm and heroism which largely account for the selection of the 47th Squadron as a permanent unit of our Air Force. History in this form is a necessity for the building up of an *esprit de corps* in so entirely new an arm as the R.A.F. The author of "Over the Balkans" has approached his task in a spirit of admiration of his comrades and their deeds in the past, whilst, where sympathetic treatment is essential, incidents are treated with that reverence which suggests a touch begotten of personal experience. Moreover, the author has succeeded in not only compiling facts of historical importance, but has also dealt with them in such form as to give the work the character of a consistent story.

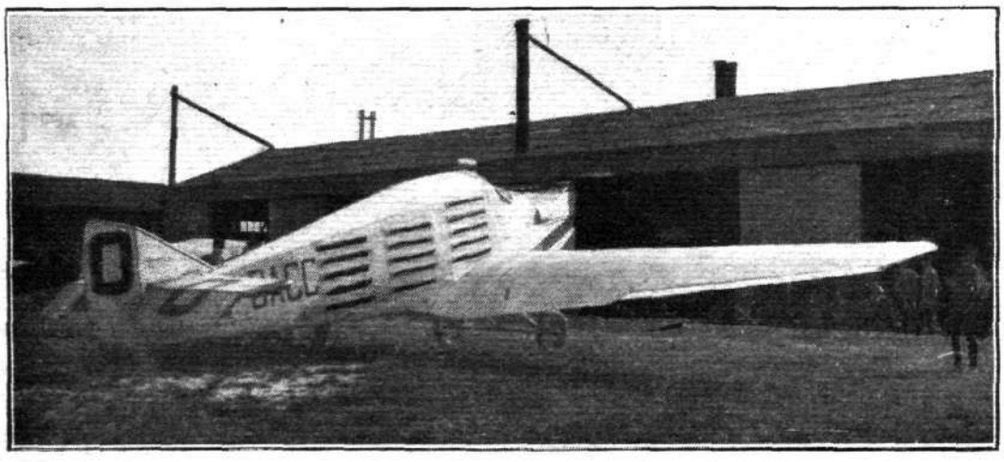
From the Preface by the author and a "Foreword" by Air Vice-Marshal Sir W. G. H. Salmond, to the end of Appendix III, every page carries its facts, put forward in plain, simple, but convincing words. The compilation is more than justified by Sir W. G. H. Salmond, who states "it is good that it is published," and that the R.A.F., Middle East, embraced an operational area which no command in any service has hitherto approached—No. 47 Squadron being quoted as a typical example of a Middle East squadron, one in which all ranks carried out their duties with splendid efficiency, and displayed a bravery, tenacity, and adaptability to all circumstances in keeping with the highest traditions of our fighting forces. And be it remembered Sir W. G. H. Salmond speaks from personal knowledge of the squadron.

The "contents" by itself is such a full epitome of the book that one can almost say it constitutes the history and work of No. 47 Squadron in "tabloid" form. We give below, therefore, a *résumé* of its "headings" which will almost convey to our readers details of this book. It should be mentioned, before we turn to the contents, that this work is illustrated with a number of excellent photo. reproductions, mostly aerial views of the various "places of interest," and outline maps of the scenes of operations.

Here are the chapter heads, in the order in which they are given, with the principal incidents, etc., therein :—*Part I.*—Macedonia; Outward Bound—The Squadron embark at Devonport; Early Adventures—The *Menominee* arrives at Salonika—No. 47 march to Karaissi—The move to Mikra Bay—The Story of the Balkan Campaign—Accidents to Machines—H.Q. and "A" and "B" Flights move to Janus and "C" Flight to Kukus; The Routine of a Corps Squadron (quite an interesting chapter this, which helps one to follow subsequent portions of the book); The First Winter—The Aerodrome at Janus—First Bomb Raid on the Aerodrome—Aeroplanes co-operate with Infantry at Krastali—"C" Flight move from Kukus to Snevce—47 receives visit from General W. G. H. Salmond—A Machine of 47 collides in the Air with a Hostile Aeroplane (and there are many other exciting and amusing incidents given); Gothas! (another good chapter)—Enemy No. 1 Bombing Squad. arrive at Hudova—They bomb French Aerodrome at Gorgop, Janus, Salonika, etc.—Counter-bombing with the help of the R.N.A.S.—Twenty Machines bomb Hudova—Composite Flight formed at Hadzi-Janus—Lieut.-Col. Dawes temporarily disappears—Bamford and Wilkinson collide in the Air—An Adventure with Nurses from No. 20 Stationary Hospital—"F" Squad. R.N.A.S. arrives at Amberkoi—"F" Squad. blown up at Marian—Enemy Bombing Squadron leaves the Front; The Battle of Dorian, 1917—Description of the Country between Lake Dorian and the Vardar, etc., etc.; Summer Nights—and Gnats (another chapter full of "incidents"); The Second Winter—Flights reorganised for Artillery Co-operation—Night Bombing—New Scout Machines in use—Sortie of the *Goeben* and *Breslau*—47 co-operate in Bombing Attacks—No. 150 Squad. formed; The Final Push—Lieut.-Col. Todd takes command of the 16th Wing—Mutiny among the Bulgars—Major F. A. Bates takes over 47 Squad.—Franco-Serbian success opens way for British Attack—The Attack—Brandt and Gerhardi down in Flames—Landing Spies—Reconnaissances show Enemy Retreat—The great Bombing Attacks from the Air—Bulgars sue for Peace—Convention Signed—47 land at Hudova.

Part II.—South Russia: Denikin's Campaign (a most interesting chapter)—The Epic Story of the Volunteer Army—Gen. Alexieff builds up an Army on the Shores of the Black Sea—Gen. Alexieff dies and Gen. Denikin takes Command—The Opposing Armies at the end of 1918—The Attack—Ukrainians and Cossacks give way—Further Progress—The Lack of Clothes and Medical Comforts—The Red Army Counter Attack—Denikin's Army pushed Back—Loss of Kiev—Wrangle evacuates Tsaritsin—Rapidity of Bolshevik Advance—Denikin evacuates Remnants of Army *via* Novorossisk and leaves for England; In South Russia—47 clear up in Macedonia—Reconnaissances against Turkey and flights to Sofia—Concentrate at Amberkoi—Leave for South Russia (April, 1919)—Arrival at Novorossisk—Major Collishaw takes command of 47—"C" Flight sent to operate against Tsaritsin—The Adventures of "C" Flight on way to Volga—Arrive at Gniloaksaiskaya—They raid Tsaritsin—Further Raids—Move to Beketovka—Capt. Anderson lands among Bolshevik Cavalry and makes a Rescue—How "C" Flight celebrated Peace Day—Bombing Barges on the Volga—Concentrates at Beketovka—"B" Flight on "Camels" do effective Ground Strafing—47 protest that they "want to fight" and become a Volunteer Unit of South Russian Army. Appendix I.—Summary of the History of 47 Squad. in Macedonia; Appendix II.—Casualties: A. Macedonia, B. South Russia; Appendix III.—Honours and Awards: A. Macedonia, B. South Russia.

* Edward Arnold, Maddox Street, London. 10*s.* 6*d.* net.



A Flying "Pigeon Loft": This Junkers monoplane has been converted by a Belgian company for carrying pigeons, the Belgians being fond of pigeon races.

FLIGHT
AIRCRAFT ENGINEER AND AIRSHIPS

WATER-COOLED AERO ENGINES

UNDER above title Mr. A. J. Rowledge read a very interesting paper before the Institution of Automobile Engineers on January 9, 1924. The paper was one of considerable length, and space does not allow of giving it here in full. Some of the main points are, however, dealt with in the following summary :

The lecturer pointed out that the aero-engine designer was not, in most cases, an aeroplane designer also, and that he often found it difficult to place the true relative value of the various points in his engine specification. With regard to the two main divisions into which aero engines fall, *i.e.*, water-cooled and air-cooled, he thought it probable that both types would continue to be used, as neither had reached the limits of its possible development, and each had special characteristics making it especially suitable under certain conditions. For the water-cooled engine the lecturer stated that it could be claimed to have accomplished almost all the great performances in the air, and that it might be expected that it would be possible to build a faster machine with a water-cooled engine than with an air-cooled. With water cooling, Mr. Rowledge added, the temperature was under better control, and the problem of heating the mixture pipes and carburettor was also considerably simplified.

Low weight per brake horse-power was an important point, and if the consideration could be taken far enough to take the weight of the whole power plant against the thrust horse-power developed, the whole question of suitability would be fairly simple. The lecturer thought that the direct-injection heavy-oil engine was in a very early stage of development, but that if the system met with success it would solve many outstanding problems. Continuing, Mr. Rowledge said : " The question of economy in its various aspects, covering cost of production, running costs, and maintenance costs, requires more than superficial consideration, and has to be considered in relation to the complete aeroplane. It is of little use to have an engine that can be built for a low price per brake horse-power and use a low-priced fuel if its performance is poor, and if it not only requires to be of much greater horse-power itself, but requires also a larger and more costly aeroplane to perform the same duty."

Taking the case of an aeroplane with a total weight per horse-power of 15 lbs. and whose engine weighed 3 lbs./h.p., the engine would have to develop 218 b.h.p. to carry 1,000 lbs. useful load for four hours. If the engine weight was increased to 5 lbs./h.p., the engine would have to develop 374 h.p. and would need a larger machine. The dry weight of a water-cooled engine was, he said, smaller than the dry weight of an air-cooled engine of the same cylinder dimensions and arrangement, but the added weight of water and radiators brought the weight up to a greater figure than that of an air-cooled engine. He claimed, however, that the water-cooled engine gave greater power for the same cylinder capacity.

Variable Pitch Airscrews

On the subject of variable pitch airscrews and two-speed gears Mr. Rowledge said : " Another subject that it is worth our while to investigate in considering the best type of aero engine, and one which will have a great effect on the type, is the provision of a variable pitch airscrew, or the alternative of a variable speed gear. Engine builders in the past have usually left the airscrew to the aeroplane designer, and probably each has been too busy on essential details to concentrate on this apparently difficult problem. It certainly seems unfortunate that the variable pitch airscrew has not made more rapid progress. The alternative, a two-speed gear, is at present being designed and constructed. A good two-speed gear does not appear to present a difficult problem, and it is probably easier to deal with than a variable pitch airscrew. If we regard the additional weight due to the two-speed gear as negligible, the result will be greatly improved take-off and climb, and better fuel efficiency when cruising, as the engine can be run at its most economical load. It is rapidly becoming the practice of civil aviation firms to run their engines as though they were on the low gear all the time. In this case the advantages will be better fuel economy, and a great improvement in reliability and engine life, owing to the lower revolution speed and higher brake mean effective pressure when cruising, but we cannot expect to improve the climbing speed as well. The weight per brake horse-power climbing can be reduced, say, 10 per cent., an improvement well worth while. Such a gear can also be used to maintain the speed of the airscrew when flying at high altitudes, although in this case, as the engine will have to run faster, it will be at some loss of reliability, and justifiable only as a military expedient."

On the question of number of cylinders and bore/stroke ratio Mr. Rowledge arrived at the conclusion that a fairly long stroke, say 1·4 times the bore, was desirable, while for engines up to 750 h.p. the 12-cylinder V-type was, on balance, preferred, although he considered that there was very little to choose between the 12-cylinder V-type and the triple-four type. Reference was made to the Report of the Safety and Economy Committee, in which it was suggested that the desirable airscrew speed should be based on a formula such as $20{,}000/\sqrt{\text{b.h.p.}}$, while in the regulations for the forthcoming French engine competitions it was stipulated that the airscrew speed must not exceed $32{,}000/\sqrt{\text{b.h.p.}}$, the following formula being used for obtaining the power at the airscrew :—

$$\text{Power at airscrew} = \text{b.h.p.} \times (32{,}000/\text{revs.}\ \sqrt{\text{b.h.p.}})^{0.1}.$$

This formula, he said, gave us something to work upon, but was unsatisfactory in assuming indefinite increase in propeller efficiency with decrease in revolutions, whereas it should give maximum marks for an engine driving the airscrew at the most efficient speed, and deduct marks from engines in which the airscrew ran either faster or slower than this speed. The lecturer then added : " Difficulties of this sort always occur in drawing up competition rules, but it is evident that the compilers in this case were very anxious to encourage low speed. If a complete set of regulations for a competition for aero engines were drawn up by machine designers, it would be of very great value to engine designers when deciding their programme of future development without any competition ever taking place.

" Taking as an example an engine of 500 b.h.p., having its airscrew mounted directly on the crankshaft, and running at 1,400 r.p.m., the power at the airscrew by the above formula is 501. If a reduction gear is interposed between the engine and the airscrew, and we take the revolutions per minute as 893 from the formula of the Safety and Economy Committee, then, using the same formula for power at the airscrew as in the first case, we arrive at a figure of 525 against 501 in the direct-drive case. These figures look curious, but evidently the framers of the competition rule were taking a high-speed direct-drive job as their basis."

Cooling System

Under this heading Mr. Rowledge stated that : " Water as a medium for transferring the heat from the cylinder-wall surfaces to the radiator surface possesses many advantages to offset the apparent simplicity of direct air cooling. The high specific heat of water means that it can absorb a large number of B.Th.Us. without its temperature rising unduly. It also prevents local hot spots in the combustion space, an important point assisting reliability and fuel economy. In addition, it enables the cylinders to be arranged in a suitable form for small head resistance due to the engine, and lends itself to body forms which give the pilot a good view, while the cylinders can be placed closer together, making the engine more compact, and, of course, lighter. The latest American racing machines are examples of how the head resistance due to cooling can be reduced to a minimum by the use of this system, a result that air cooling can never attain. The weight of the cooling system adds to the dry weight of the engine about 0·6 lb. per brake horse-power for a long-range machine, including the weight of the radiator, radiator shutters, pipes, tanks and water.

" The system has to get rid of from 20 to 24 B.Th.Us. per brake horse-power per minute. A certain amount of heat is used to warm the carburettors and mixture pipes, and this is not included in the figures to be dealt with by the radiator. The provision of an alternative source for the supply of the heat necessary for this purpose in an air-cooled engine is a matter of difficulty.

" The water circulation is always maintained by a pump of the centrifugal type. The spindle of the water pump is in most engines grease-lubricated, but in the R.R. 'Eagle' engine the lubrication of this part is satisfactorily effected by using the circulating water only for the purpose. The British standard rate of flow through the radiator is 15 gals. per 100 b.h.p. per minute, an ample quantity under all conditions.

" It is probable that slight pressure loading of the system will be resorted to in the future to increase the efficiency by raising the maximum temperature that can be used, thus increasing the difference between the radiator and air temperatures."

Crankshafts

Stiffness was, perhaps, a more important attribute than strength in this important part. The complete stressing of a crank design was a very complicated piece of work taking

many weeks, but methods had been developed to a sufficient point to enable crankshafts to be designed safely very close to the minimum possible weight.

Petrol and Oil Systems

The lecturer pointed out that in the lubricating systems of aero engines there was very little variation, the dry sump and separate oil tank, with scavenger pump returning the oil from bottom of crank-case, being universally used, with pressure pumps drawing oil from the tank and supplying it to the bearings under pressure. The features requiring most care were the filters and the pipe lines. By careful design the straggly type of pipe of the nut and nipple variety could be practically eliminated. More provision than was usually made for cooling the oil and regulating its temperature was desirable. The faster the oil could be passed through the bearings the better, provided an excessive supply did not get to the pistons. The usual speed of circulation was about 6 to 8 pints per 100 h.p. per minute.

The petrol system should be as simple as possible, and the lecturer stated that gravity feed was greatly to be preferred where possible. There was, however, no great problem connected with the design of a petrol pump, except as regards the glands. The pump should be driven direct from the engine, and not by a windmill.

Engine Suspension

This called for close co-operation between the engine designer and the aeroplane designer. The main requirements were stiffness, provision for easily removing and replacing the engine, and accessibility to all parts requiring attention. The torque reaction should be taken as near to the airscrew end as possible. On the whole, the lecturer thought it seemed desirable to make the crank-case stiff enough to act as a tie between the engine bearers. A slide was shown of the Rolls-Royce "Condor III," in which the usual idea of bearer bars has been discarded.

Ignition and Carburation

Mr. Rowledge did not add any new information on the questions of ignition and carburation. He pointed out the advantage of dual ignition, and stated that in seaplane work there was a difficulty in keeping the sparking plugs and insulation dry, the trouble being increased by the metal screening necessary to prevent the wireless instruments from being interfered with by the waves from the ignition system. The range of control necessary on aircraft was so small that it was usual to connect the ignition control to the throttle control.

In some respects the problem of the aero engine carburettor was much simpler than for motor-car work, but was greatly complicated by the need to work in varying air densities.

Airscrews and Gearing

After a brief reference to the ordinary wood airscrew, and a mention of the Leitner-Watts metal propeller, the lecturer turned to the question of reduction gearing. He stated that there were two successful types: the epicyclic and the straight spur. The former had the advantage of putting less strain on the crankcase, but by modification in the design of the system of carrying the engine in the frame the simple spur type could be arranged so that the maximum load on the framework was only that due to the torque reaction of the airscrew, as in the case of the epicyclic gear. Slides were shown of the epicyclic gear of the Rolls-Royce "Eagle" and the plain spur of the "Condor III." The lecturer, in referring to machines with central engines, expressed the opinion that the weight of the necessary clutches and gearing was too great a handicap to make the scheme likely to be of much permanent use, and that the use of a number of engines suitably placed and each complete in itself was more likely to give freedom from engine breakdown.

The fuel question was referred to next, and the lecturer thought that improvement in fuels opened up great possibilities, and that it would be along this path that the greatest steps to economy would be made in the near future.

Superchargers

This subject was referred to briefly, the lecturer expressing the opinion that we should expend some of our energies in developing a mechanically-driven blower. For multi-engined machines he preferred a separately driven blower, on the lines developed in Germany during the War. Probably, the lecturer stated, the mechanically-driven blower reached its maximum development in Germany in 1918, since when it appeared to have been badly neglected.

In conclusion, Mr. Rowledge showed slides of the Rolls-Royce "Condor III," and an average curve of brake horse-power, as well as a typical indicator diagram.

LONDON TERMINAL AERODROME

Monday Evening, January 7, 1924

FLYING has taken place spasmodically in between spells of bad weather this week. There has been snow in Holland and Germany, which has interfered with the regular running of the services to these parts, and on one occasion, after a sudden thaw, the aerodrome at Rotterdam was covered to a depth of several inches with half-melted snow, and it was like landing in water. Several machines have landed during snowstorms, the pilots reporting that the engines have fallen off in "revs." to an alarming extent whilst going through the storms. On the ground the engines have shown full "revs.," and it is thought that snow getting into the intake pipes has caused this drop.

The new strontion beacon is proving very successful. Several pilots arriving late in the evening, when this light has been working, have stated that it is the most easily distinguishable light on the aerodrome, not only because of its colour, but also owing to the fan shape of its beam, which catches the eye of the pilot when several miles away from the aerodrome.

Mrs. Atkey, a woman pilot, has been making several flights during the week on a D.H.9, and is now proving quite a proficient pilot. I understand that she has purchased this D.H.9, and intends to use it for flying about the country and on the Continent.

CORRESPONDENCE

THE SELFRIDGE PRIZE

[2083] It appears, judging from your correspondence columns, that quite a number of enthusiastic readers are building machines or experimenting with a view to competing for Mr. Gordon Selfridge's 1,000-guinea prize for a glider flight of 50 miles.

On the face of it, it would seem a thousand pities, subject, of course, to Mr. Selfridge keeping this offer open for 1924, to transfer this incentive to the light 'plane class, as the latter will have, I believe, prizes offered for competition by the Air Ministry.

The transference of this offer will, undoubtedly, cause much disappointment, and inflict perhaps some little hardship on those who have been unable to complete their machines.

Might I suggest, therefore, that, in order to get some tangible results, the offer be kept open for another year for individual attempts, but to hold a week's or a fortnight's flying meeting, at a place to be decided on by the Royal Aero Club, during the summer months—say, July or August—at which this particular prize could be competed for. I suggest July or August as the majority of these enthusiasts, including myself, have our vacation at this period, and it would enable us to complete our plans for this event. Perhaps it could be arranged that the light 'plane competitions could be held at the same time?

However, all of this, of course, is purely a matter of arrangement, and subject, of course, to Mr. Selfridge still keeping the offer open, and also that the prize is not individually won in the meantime.

GEORGE W. CAIN

Hornsey, N. 4.

"Dixmude's" Commander

THE body of the late Commander of the ill-fated "Dixmude," Lieut. Plessis de Grenadan, has now been examined by doctors at Toulon, and their report states that the Commander was not drowned, but met his death while still in the air. His heart, it is stated, had burst with the pressure of air due to a rapid fall. It is understood that a splinter from the airship was found embedded in the flesh, which fact is taken to indicate that the airship was struck by lightning and that an explosion rent the ship asunder, the pieces of wreckage dropping rapidly into the sea.

NOTICES TO AIRMEN

Bulgaria : Adhesion to International Air Convention : Bojourishte Aerodrome

1. THE Bulgarian Government adhered to the International Air Convention as from July 5, 1923, the Convention taking effect forthwith for Bulgaria in respect of the contracting States.

2. The Bulgarian Government have requested that they may, in every case, be given warning of the arrival of British aircraft in Bulgaria, in order that facilities may be forthcoming. Pilots intending to fly to Bulgaria should, therefore, give previous notice to the Bulgarian Legation, 3, Queensberry Place, London, S.W. 7.

3. The following aerodrome is available.

Bojourishte.—Civil Customs aerodrome.

Position.—Latitude 42° 45′ N., Longitude 23° 12′ E. Situated 12 kms. N.W. of Sofia, on the S.W. side of the road to Slivnica and Nish, and to the immediate S.E. of the village of Bojourishte.

Description.—Level surface; very soft in wet weather. Dimensions for landing, 600 × 800 yards.

Height above sea level.—1,850 ft. (approx.).

Obstructions.—On N. side are hangars and on N.W. side the village of Bojourishte and trees.

Accommodation, supplies, etc.—Hangars and probably petrol and oil and facilities for repairs are available.

Communications.—Sofia railway station, 12 kms. to S.W There is a railway siding to the aerodrome and a small station 3 kms. distant.

(No. 108 of 1923.)

Cruisers as Aircraft Carriers

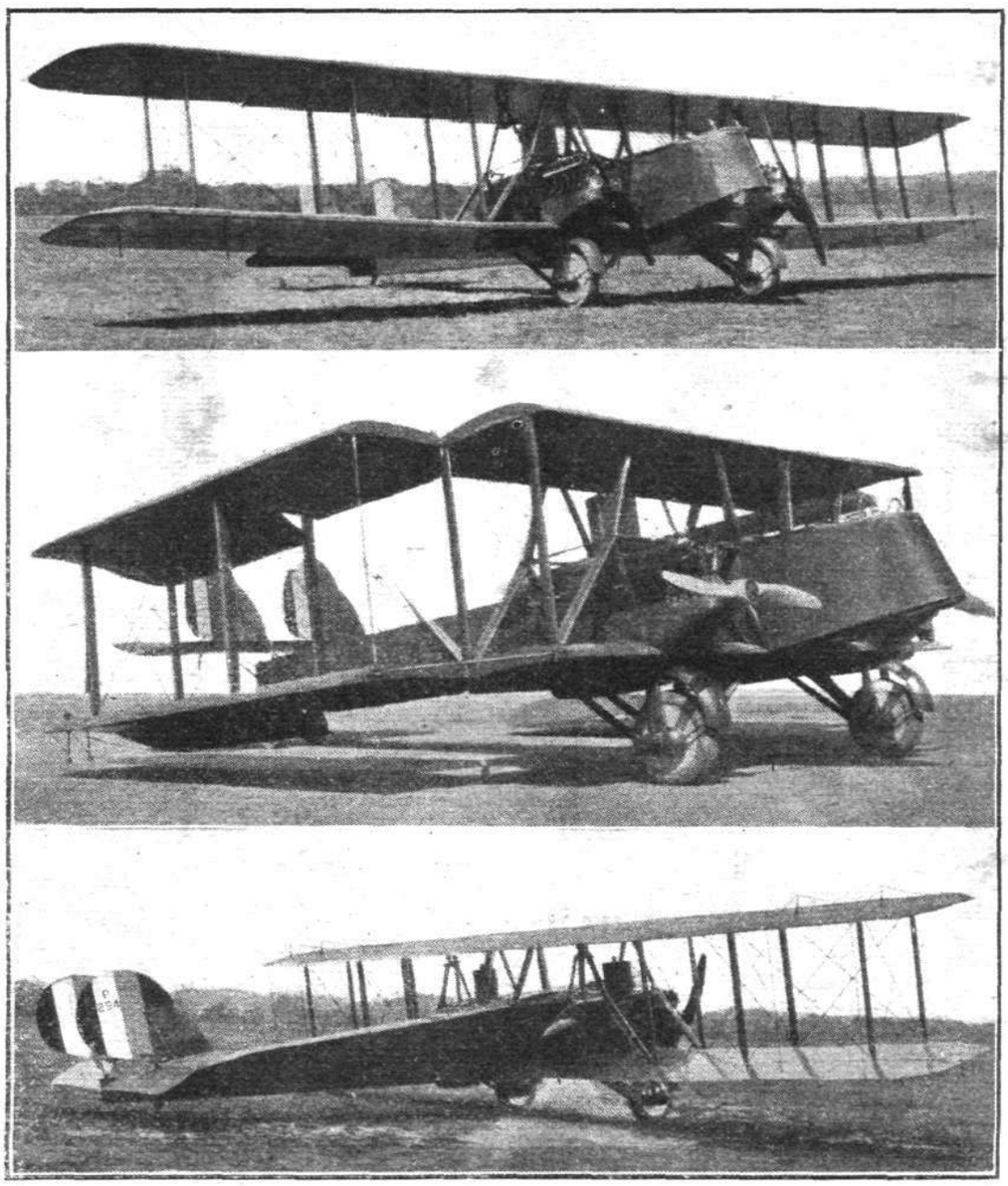
IT was announced in naval orders at Devonport, on January 7, that the cruisers *Glorious* and *Courageous* are to be converted into aircraft carriers. The *Glorious* will, it is stated, be converted at Rosyth, while the conversion of the *Courageous* will be carried out at Devonport dockyard. The two cruisers are of 18,600 tons, and their armament includes four 15-in. and 18 4-in. guns.

Sadi Returning

M. SADI LECOINTE, the famous French pilot, is returning shortly from the Antilles, where he has been demonstrating a Schreck F.B.A. flying boat. Using Guadeloupe as a base, Sadi has made flights to a number of the surrounding islands, and we do not envy him having to return to the snow and slush of more northern latitudes.

The Schneider Cup, 1924

THE F.A.I. announces that the seaplane race for the Schneider Cup will take place in the United States during 1924, under the same rules as obtained for last year's race at Cowes.



The Curtiss night bomber : A large number of these machines (over 90) were built for the U.S. Air Service during the summer of 1923. The N.B.S.1, as it is called, is a twin-engined biplane on the lines of the Martin bomber. It possesses, however, several important modifications, principally in the position of the two Liberty engines and in the strengthening of the fuselage. As will be seen, the wings can be folded back, and when folded the outer extensions are rigidly supported by means of auxiliary struts at the hinge.

THE AIR COUNCIL

FROM an Order-in-Council, given below, it will be seen that the Air Council and the duties attached are for 1924 much the same as before. The Order states that the Council shall consist of the following members :—

One of His Majesty's Principal Secretaries of State, who shall be President of the Air Council.

The Parliamentary Under-Secretary of State for Air.

The Chief of the Air Staff.

The Air Member for Personnel.

The Air Member for Supply and Research.

The Secretary of the Air Ministry.

Of the members of the Air Council (other than the President) the Chief of the Air Staff shall be appointed by His Majesty and the other members shall be appointed by the Secretary of State.

There may be included in the Air Council such additional members (if any) not exceeding two, as may be appointed by the Secretary of State ; and the Secretary of State is to be responsible to His Majesty and Parliament for all the business of the Air Council.

All business, other than business which the Secretary of State specially reserves to himself, is to be transacted in the following principal divisions :—

(*a*) The Parliamentary Under-Secretary of State for Air to be Vice-President of the Air Council and to be responsible to the Secretary of State for the business of the Air Council, and in particular of that relating to Civil Aviation.

(*b*) The Chief of the Air Staff to be the first and Senior Air Member of Council, and principal adviser of the Secretary of State in the direction of the Air Force ; and in particular to be responsible to the Secretary of State for the administration of the business relating to the disposition, command, employment, organisation, communications, and works services of the Air Force.

(*c*) The Air Member for Personnel to be responsible to the Secretary of State for the administration of the business relating to the personnel, discipline, and training of the Air Force.

(*d*) The Air Member for Supply and Research to be responsible to the Secretary of State for the business relating to the equipment, armament, maintenance, and transport of the Air Force, and to aeronautical research and inspection both for the Air Force and for civil purposes.

(*e*) The Secretary of the Air Ministry to be responsible to the Secretary of State for such duties discharged by the Air Ministry as are not assigned to other members of the Council, for the control of expenditure, and for the co-ordination of Air Ministry business ; and to be also designated Secretary of the Air Council, and as such charged with the preparation of all official communications of the Council.

Silly questions we have been asked :



" Were you ever in any aerial combats, Major ? "

FLIGHT

THE ROYAL AIR FORCE

London Gazette, December 21, 1923

Stores Branch

The following Flying Officers on probation are confirmed in rank :—H. A. Lotherington, E. G. Jolliffe.

London Gazette, January 1, 1924

General Duties Branch

Squadron Ldr. (hon. Wing Comdr.) G. H. Thomson, O.B.E. (Paymr. Comdr., R.N.), relinquishes his temp. commn. on return to Naval duty; Jan. 1.

Stores Branch

Flying Officer J. P. Crichton is placed on retired list on acct. of ill-health; Nov. 28, 1923 (substituted for *Gazette*, Nov. 13, 1923).

London Gazette, January 4, 1924

General Duties Branch

The following Air Commodores are promoted to rank of Air Vice-Marshal, with effect from Jan. 1 :—F. R. Scarlett, C.B., D.S.O., H. R. M. Brooke-Popham, C.B., C.M.G., D.S.O., A.F.C. (substituted for *Gazette*, Jan. 1).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Air Commodore C. A. H. Longcroft, C.B., C.M.G., D.S.O., A.F.C., to Air Ministry. 10.12.23.

Wing Commander A. S. Barratt, C.M.G., M.C., to R.A.F. Depot, whilst attending course at Staff College, Camberley. 21.1.24.

Squadron Leaders: J. Kemper, M.B.E., to Inland Area Aircraft Depot, Henlow. 14.1.24. E. L. Tomkinson, D.S.O., A.F.C., to C. and M. Party, Cattewater. 7.1.24.

Flight Lieutenants: B. A. Malet, D.F.C., to No. 2 Flying Training Sch., Duxford, for course of instruction. 14.1.24. R. W. G. West, to R.A.F. Depot (non-effective pool). 17.12.23. C. B. Cooke, to No. 60 Sqdn., India. 12.12.23. W. H. Ellison, to Aircraft Depot, India. 21.11.23. H. P. Lloyd, M.C., D.F.C., to Sch. of Army Co-operation, Old Sarum. 13.1.24. C. F. Browerton, D.S.C., to R.A.F. Base, Gosport. 13.1.24. L. G. Harvey, to No. 1 Sch. of Tech. Training (Boys), Halton. 13.1.24. C. H. C. Woollven, M.C., to Inland Area Aircraft Depot, Henlow. 14.1.24. Hon. R. A. Cochrane, A.F.C., to Boys' Wing, Cranwell. 14.1.24. C. B. Dick-Cleland, to No. 12 Sqdn., Northolt. 1.2.24. C. R. Keary, to No. 25 Sqdn., Hawkinge. 14.1.24. S. E. Adams, to R.A.F. Depot (non-effective pool). 1.1.24. V. A. Albrecht, O.B.E., M.C., to No. 111 Sqdn., Duxford. 21.1.24. P. L. Plant, to R.A.F. Depot. 15.1.24. R. M. Foster, D.F.C., to R.A.F. Base, Gosport. 13.1.24. G. E. Livock, D.F.C., to C. and M. Party, Cattewater. 7.1.24. C. McM. Laing, M.C., A.F.C., to R.A.F. Depot. 14.1.24. J. A. Boret, M.C., A.F.C., to No. 100 Sqdn., Spittlegate. 14.1.24. R. Jope-Slade, D.S.C., to Armoured Car Wing H.Q., Iraq. 24.4.23. A. M. Wray, M.C., A.F.C., to Aeroplane Experimental Estabt., Martlesham Heath. 14.1.24.

Flying Officers: L. A. C. Stafford, to No. 2 Flying Training Sch., Duxford, for course of instruction. 14.1.24. G. R. O'Sullivan, to Inland Area Aircraft, Depot, Henlow. 1.1.24. C. B. Greet, to No. 32 Sqdn., Kenley. 4.1.24. W. C. P. Bullock, N. C. Ogilvie Forbes, F. R. Woolliams, and A. F. Lingard, all to R.A.F. Base, Leuchars. 4.1.24. H. R. Vaughan Fowler, to R.A.F. Base, Leuchars, on appointment to a short service commn. 29.12.23. W. V. Simons, to R.A.F. Depot, pending disposal on transfer to Home Estab. 19.1.24. E. J. Ffoulkes-Jones, to No. 2 Flying Training Sch., Duxford. 14.1.24. D. R. Mitchell, M.B.E., to Marine and Armament Experimental Estab., Isle of Grain. 14.1.24. G. J. Stroud, M.B.E., to No. 1 Sch. of Tech. Training (Boys), Halton. 14.1.24. S. Upton, to Inland Area Aircraft Depot, Henlow. 14.1.24. O. E. Carter, to No. 27 Sqdn., India. 9.12.23. L. W. Park, to No. 6 Armoured Car Co., Iraq, instead of to No. 4 Armoured Car Co., as previously notified. 14.9.23. E. P. M. Davis, A.F.C., A.M., F. H. Isaac, D.F.C., A. J. Rankin, and H. A. Dinnage, all to C. and M. Party, Cattewater. 7.1.24.

Pilot Officers: K. R. Brown, to No. 25 Sqdn., Hawkinge. 4.1.24. C. W. A. Byrne, to No. 29 Sqdn., Duxford. 4.1.24. C. F. Roupoll, to No. 7 Sqdn., Bircham Newton. 4.1.24.

Stores Branch

Flight Lieutenant W. G. MacD. Nicholl, to Armament and Gunnery Sch., Eastchurch. 14.1.24.

Flying Officer W. A. Glasper, to Aircraft Depot, India. 9.9.23.

Medical Branch

Squadron Leader R. A. G. Elliott, M.B., B.A., to H.Q., Palestine. 10.12.23.

Flight Lieutenants: A. F. Rook, M.R.C.P., D.P.H., to remain at R.A.F. Central Hospital, Finchley, instead of to R.A.F. Hospital, Cranwell, as previously notified. M. Coghlan, M.B., to remain at Sch. of Tech. Training (Men), Manston, instead of to R.A.F. Depot, as previously notified. W. Parsons, to No. 1 Sch. of Tech. Training (Boys), Halton. 2.1.24. E. G. Howell, to Research Lab. and Medical Officers' Sch.of Instruction, Hampstead, on appointment to a short service commn. for short course. 31.12.23.

Flying Officers: R. W. White, to remain at R.A.F. Hospital, Cranwell, instead of to R.A.F. Central Hospital, Finchley, as previously notified. G. A. Ballantyne, D.F.C. (Dental), to R.A.F., on appointment to a temporary commn. on attachment from the Army. 1.1.24.

Air Ministry, January 1, 1924.

Promotions.—The undermentioned officers are promoted to the ranks stated, with effect from January 1, 1924 :—

Stores Branch

Flight Lieutenants to be Squadron Leaders.—George Stevens, O.B.E.; Francis George Maxwell Williams; John Samuel Goggin; Percy Mead Brambleby; Frederick Grave, M.B.E.

Flying Officers to be Flight Lieutenants.—George Arthur Curtis; Alfred George Knight, M.B.E.; Eric Leighton Ridley; John Hobbs; Lewis Edward Carter, D.C.M.; Charles Edward Cullen; Frederick Whilton, D.C.M.; Leonard Henry Vernon.

Stores Branch Accountants

Squadron Leaders to be Wing Commanders.—William Hughes Holroyd; Herbert John Down.

Flying Officers to be Flight Lieutenants.—Edwin James Grout; Robert Milne Grundy; Herbert Wellstead Capener; Robert Frederick Charles Metcalfe; Sidney Glanvill Linssen; Edward Charles Mackintosh Knott.

TO THE NORTH POLE BY AIR

CAPT. RAOUL AMUNDSEN is going to make another attempt in the summer of this year to reach the North Pole *via* the air. This time, it would seem, the expedition is being planned on a somewhat more elaborate scale, whilst arrangements have been completed with the U.S. Navy Department for Lieut. Ralph E. Davison, U.S.N., to take part in the expedition and command one of the three seaplanes which will make the polar flight. So once again America is giving practical and not merely moral support in matters aviatic. The Amundsen expedition will be transported by ship to Spitzbergen about the end of May. Here a base of operations will be established, and in the early summer the aeroplanes will be carried by ship to the edge of the ice pack—about 450 miles or so from the North Pole. From this point flights will be made to the Pole, where a depôt of supplies of food and fuel will be established. Dornier "Dolphin" metal flying boats, specially constructed to take off and land on ice, snow, or water, will be used. They will be fitted with wireless receiving and transmitting sets, so that they may keep in touch with the depôt ship. The latter will be equipped with a high-power wireless installation, and will "broadcast" to the world the progress of the expedition.

Six men will man the three flying boats, Capt. Amundsen being in command of one, and Lieut. Davison in command of another. One of the objects of the expedition will be to discover whether or not the theory now held by scientists, that a large continent exists in this region, is correct. The feasibility of transpolar air routes, linking up the East and West in air lines over the shortest routes between Northern Europe and the Pacific, will also be investigated.

Non-stop flights over the Arctic regions are not contemplated, and it is intended to make several flights in the vicinity of the Pole before the actual transpolar flight is attempted, so that conditions may be studied and bases established.

In addition to the Amundsen expedition referred to above, the U.S. Navy has decided, with the approval of President Coolidge, to send an expedition, also, into the Arctic during the coming summer.

While naval vessels will be used as auxiliaries, the expedition will be primarily aerial, and it is expected that the rigid airship "Shenandoah" will be used as well as heavier-than-air craft. Full details of this expedition are not yet to hand, but we hope to give some further particulars very shortly. It is interesting to note, however, that Secretary Denby has appointed a "Naval Arctic Air Board" for the purpose of thoroughly investigating all the problems connected with such an Arctic exploration, and frequent meetings have already taken place and many experts called in to help.

"A.J.S." Wireless Sets

WIRELESS now plays an important part in aviation, hence, quite apart from the present popularity of broadcasting, there must be many of our readers who are interested in wireless receiving sets. We, therefore, think this sufficient excuse for calling our readers' attention to a little book just issued by Messrs. A. J. Stevens and Co. (1914), Ltd., of Wolverhampton—a name well known in connection with motor-cycles—in which are given very complete instructions regarding the use, etc., of the A.J.S. wireless receiving sets. Some very useful and interesting information on wireless matters is also given in this handbook. A. J. Stevens and Co., it may be mentioned, are building up a reputation for their A.J.S. wireless sets equal to that enjoyed by A.J.S. motor-cycles. The two-, three-, and four-valve receiving sets made by this firm are extremely efficient and very handsomely finished. Unfortunately, lack of space will not permit our giving a description of these sets—just at the moment.

SOCIETY OF MODEL AERONAUTICAL ENGINEERS

THE Society will meet at the Central Y.M.C.A., Tottenham Court Road, at 7.30 on Thursday, January 17. Prospective new members and any who are interested in the work of the Society are invited to attend.

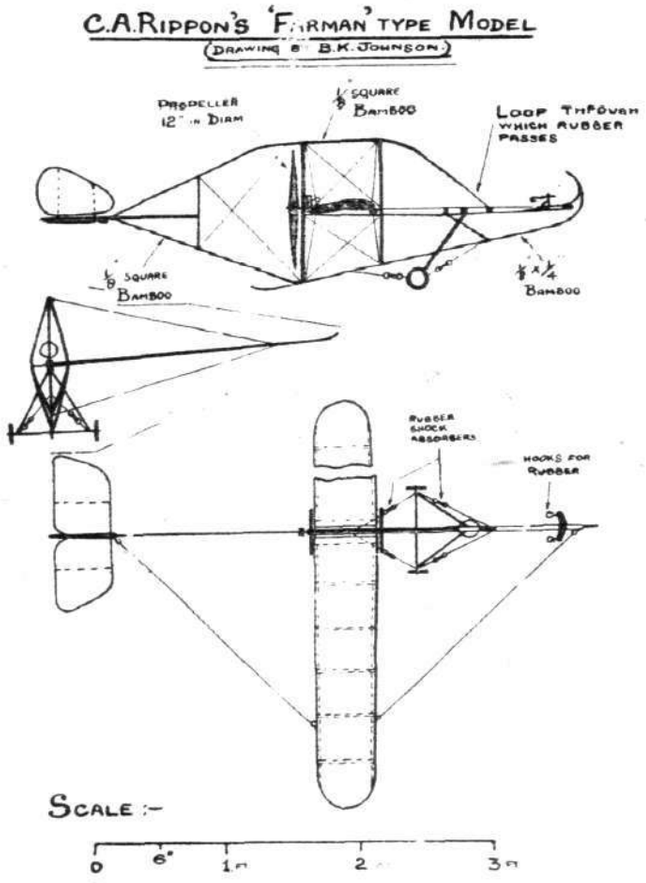
January 31 is the date fixed for the Annual General Meeting, to be held also at the Central Y.M.C.A.

Will all members please note the change of address of the Competition Secretary?

C. BAYARD TURNER, Competition Secretary.
27, Ouseley Road, Balham, S.W.

THE RIPPON "FARMAN" MONOPLANE

A TYPE of model not generally in use is that known as the Farman type, which, as its name implies, is one that has its airscrew located immediately behind the main plane, followed by the tail. Such a model, constructed by C. A. Rippon, of



the Society of Model Aeronautical Engineers, is shown in the accompanying general arrangement drawings. As will be seen, it is a monoplane with a geared rubber motor carried on a single spar, extending forward of the main plane. The tail is carried by a central V-outrigger of $\frac{1}{8}$-in. square bamboo, mounted on vertical V-struts attached to the end of the motor-spar so as to clear the propeller. A long bamboo skid extends from the bottom of the lower outrigger strut to the forward extremity of the motor-spar, when it is curved up to form a protecting buffer. The upper member of the tail outrigger extends forward and down to the motor-spar. The whole "body" is wire braced, both in the vertical plane and laterally, as shown. The main planes have a dihedral angle, as well as curved-up wing-tips. The motor consists of two skeins of 8-strand $\frac{1}{4}$-in. strip.

The principal characteristics of this model are :—

Span	4 ft. 3 ins.
Chord	$5\frac{1}{2}$ ins.
O.A. length	4 ft. 3 ins.
Area of main planes	255 sq. ins.
Area of tail plane	65 sq. ins.
Area of rudder	24 sq. ins.
Total weight	$9\frac{3}{4}$ ozs.
Loading per sq. ft.	$5\frac{1}{2}$ ozs.
Duration (officially timed), R.O.G.	35 secs.
" " Hand-launched	45 secs.

PUBLICATIONS RECEIVED

Illustrated Calendar, 1924. The Blackburn Aeroplane and Motor Company, Ltd., Olympia, Leeds.

Illustrated Calendar, 1924. Short Brothers (Rochester and Bedford), Ltd., Rochester, Kent.

Illustrated Calendar, 1924. The C.A.V. Battery Service Station, 90, High Street, Camden Town, N.W. 1.

Notiziario di Aeronautica. No. 6, *December*, 1923. Commissariato dell' Aeronautica Intendenza Generale, Rome.

Rendiconti Tecnici della Direzione Superiore del Genio e delle Costruzioni Aeronautiche. December 15, 1923. *Vol. XI, No.* 4. Commissariato dell' Aeronautica, Intendenza Generale, Rome.

Report No. 173.—Reliable Formulæ for Estimating Airplane Performance and the Effects of Changes in Weight, Wing Area, or Power. By W. S. Diehl. National Advisory Committee for Aeronautics, Washington, D.C., U.S.A.

Aeronautical Research Committee Reports and Memoranda: No. 857 (*Ae.* 97).—Biplane Investigation with R.A.F. 15 Section, Part II. By W. L. Cowley and L. J. Jones. December, 1922. London: H.M. Stationery Office, Kingsway, W.C. Price 1*s.* 3*d.* net.

U.S. National Advisory Committee Technical Notes: No. 163.—Graphic Method for Calculating the Speed and Climbing Ability of Airplanes. By A. Rohrbach and E. Lupberger. October, 1923. *No.* 164.—General Theory of Windmills. By Max M. Munk. October, 1923. *No.* 165.—Tests on Riveted Joints in Sheet Duralumin. By H. F. Rettew and G. Thumin. November, 1923. *No.* 166.—Determination of Climbing Ability. By H. Blasius. November, 1923. *No.* 167.—Wind Tunnel Tests of Five Strut Sections in Yaw. By E. P. Warner. November, 1923. National Advisory Committee for Aeronautics, Washington, D.C., U.S.A.

Catalogue

Hydravions "Cams." Chantiers Aero Maritimes de la Seine, 72, Rue la Boetie, Paris.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motor

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

APPLIED FOR IN 1922

Published January 17, 1924

28,582. SOC. ANON. DES ATELIERS D'AVIATION L. BREGUET. Braking-device acting upon the air for use in aeroplanes. (187,621.)

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